

Article, undated

An experimental structure embodying several new and interesting features of construction has recently been built by Dr. A. G. Bell at his summer home in Cape Broton.

From the general appearance down to the minutest details its construction is a departure from ordinary engineering practice.

Perched up on the top of a hill some 500 ft. above the Bras D'or Lakes, it looks like a huge camera tripod, but in reality is a Lookout Tower about 70 ft. in height, made to demonstrate the tetrahedral principle applied to large structures.

Dr. Bell has used the tetrahedral principle in the construction of his man-lifting kites for some time, finding that it gives a perfectly braced structure of great strength and lightness. It occurred to Dr. Bell that this system might be used to advantage in engineering work on a large scale and this tower is the first iron structure built on this principle.

The unit cell which is the basis of the whole tetrahedral system is the framework or outline of a solid having four sides as the word tetrahedron implies. The solution of an old trick of making four triangles out of six matches may serve to impress the idea on the minds of some. This is an impossibility if the attempt be made to get them all in one plane, but the moment it occurs to you to make a triangle 2 first and then a tripod of the other three above it is very simple indeed.

The resultant structure if the sticks are fastened at the four corners gives you a regular tetrahedral cell which is the unit of construction analogous to the brick in ordinary building. The miniature truss made of four triangles in different planes gives a framework of wonderful stiffness and strength. It also lends itself easily to combinations having the same good qualities to a remarkable extent.

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Utilizing this principle the cells used in the Tower were made of $\frac{1}{2}$ inch ordinary galvanized piping secured at the four junction points by cast iron corner pieces into which they screwed. The piping was cut into lengths of 44 $\frac{3}{4}$ inches allowing $\frac{1}{2}$ of an inch thread in each casting when the cell measured exactly 48 inches from tip to tip of the castings. One of these cells was subjected to a compressional strain of 4000 lbs. without showing the least sign of failure.

The tower which is composed of 260 of these cells rises to a vertical height of about 70 feet above the ground. It rests on three concrete foundations which go down to bed rock. A glance at these widely separated points of support (72 feet apart in the form of a triangle) at once suggests several questions as to the method of erecting the large 3 tripod structure above them, and herein lies a distinct and useful feature of the tetrahedral system. Employing ordinary methods, its erection would have been very expensive, necessitating such an immense amount of staging and falsework, but upon the cellular system of construction it was very simple and no staging or falsework of any kind whatsoever was required. Practically all the work was done on the ground, the workmen having all the advantages of terra firma until the last section was completed.

The plan of erection was a simple one. The leg containing the stair and one other leg were first built along the ground, forming a large V. In this position the foot of each leg was securely fastened by a hinge to its foundation. The hinge forming an axis about which it was free to turn if raised at the junction of the two legs (which corresponds to the point V, and was directly above the third foundation).

A system of jack screws was used to do this, and the third leg was built up section by section. For convenience and safety during this operation an arrangement like a gallows was made to support the structure while the next section was being bolted on.

It consisted of four braced uprights of stout timber with a cross beam between them. Most of the weight of the 4 structure during a lift was taken upon this cross beam under

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which two large jack screws were operated. When the structure had been lifted four feet (the length of one cell) all the weight was taken on the cross beam until the next section was firmly bolted in place which took about four minutes to do on an average. The whole weight on the third leg (always roughly equal to # of the completed tower) was then allowed to rest on the newly added section, the cross beam withdrawn from the section above and re-inserted below. This operation was repeated until after a succession of lifts the third leg had its full complement of cells and the tower was in its final position.

No real difficulty was experienced in carrying out this plan and the last section came to within a fraction of an inch of its assigned position on the foundation.

In an article like this it is impossible to go very fully into the details of the system and its possible applications but it may be well to point out a few of its best features.

First:— The rigidity of the structure was remarkable. This was well demonstrated by testing the two legs which were built along the ground as a beam. In a position very slightly inclined to the horizontal 72 feet between 5 supports, the structure only showed a deflection of about # of an inch.

Second:— The whole tower was under five tons in weight and is surprisingly strong for the material employed due to support afforded to the compression members every four feet throughout their length. A very long through member may thus be safely treated as a comparatively short post.

Third:— The inspection or even complete renewal of such a structure could be easily accomplished as no one member is indispensable to its support.

Fourth:— The material can be very rapidly assembled offering special advantage for temporary structures of various kinds.

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Fifth:— Reduces the amount of falsework and in some cases would eliminate its use altogether.

Sixth:— Very small amount of skilled labor necessary for good work.

These points appear to be some of the chief ones which make the application of the tetrahedral principle of construction to engineering work on a large scale well worth the consideration of all interested in the subject.